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A view of the water front and business district of St. Louis, one of America's leading industrial cities

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The JOURNAL *of* GEOGRAPHY

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Miss Wilcox is Demonstration Teacher in the Intermediate Grades in the public schools of Buffalo, New York. She contributed the "Teacher-Made Slide Map and its Uses" to the May number of the *Journal*. The present article deserves careful consideration by all teachers as it probably points the way to the most desirable and effective use of the so-called "New type test." It is possible to work out a series of tests of this type to fit *your own* course of study.

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VOLUME XXVII NOVEMBER, 1928 NUMBER 8

THE SUGAR SUPPLY OF THE UNITED STATES

F. A. STILGENBAUER

College of the City of Detroit

The commercial production of sugar is influenced in areal distribution by natural conditions pertaining to soil, land surface, climate, drainage, water supply, available sucrose content of plants and the prevalence of various pests and diseases. Among the cultural forms affecting sugar culture may be mentioned farm, plantation and corporation practices in cultivation, transportation, manufacture and marketing. Many plants contain some sucrose but the cane and beet have been developed to produce the bulk of the world's supply of sugar in view of the natural advantages for culture, the possibilities of increasing the sugar content and the ease of sucrose extraction. The production and marketing of sugar necessitates the handling of great bulk, therefore, home or nearby areas which are able to meet the geographic requirements for production of the cane or beet are prevailed upon by demand, competition and government regulation to produce the sugar supply of the country. In accordance with these conditions, the sugar consumed in the United States is produced in four major regions: (1) the sugar beet districts of humid areas within the United States, (2) the beet districts of semi-arid and arid areas within the country where irrigation is profitable, (3) the cane districts of home subtropical lands where climatic conditions are somewhat uncertain, and (4) the cane districts of tropical possessions, or easily accessible foreign lands, where rainfall is sufficient or irrigation feasible. An attempt will be made to point out the geographic conditions which are typical of each district and to show how more than six million tons of refined sugar reach the American market for a yearly consumption in 1925 of 106.8 pounds per capita.

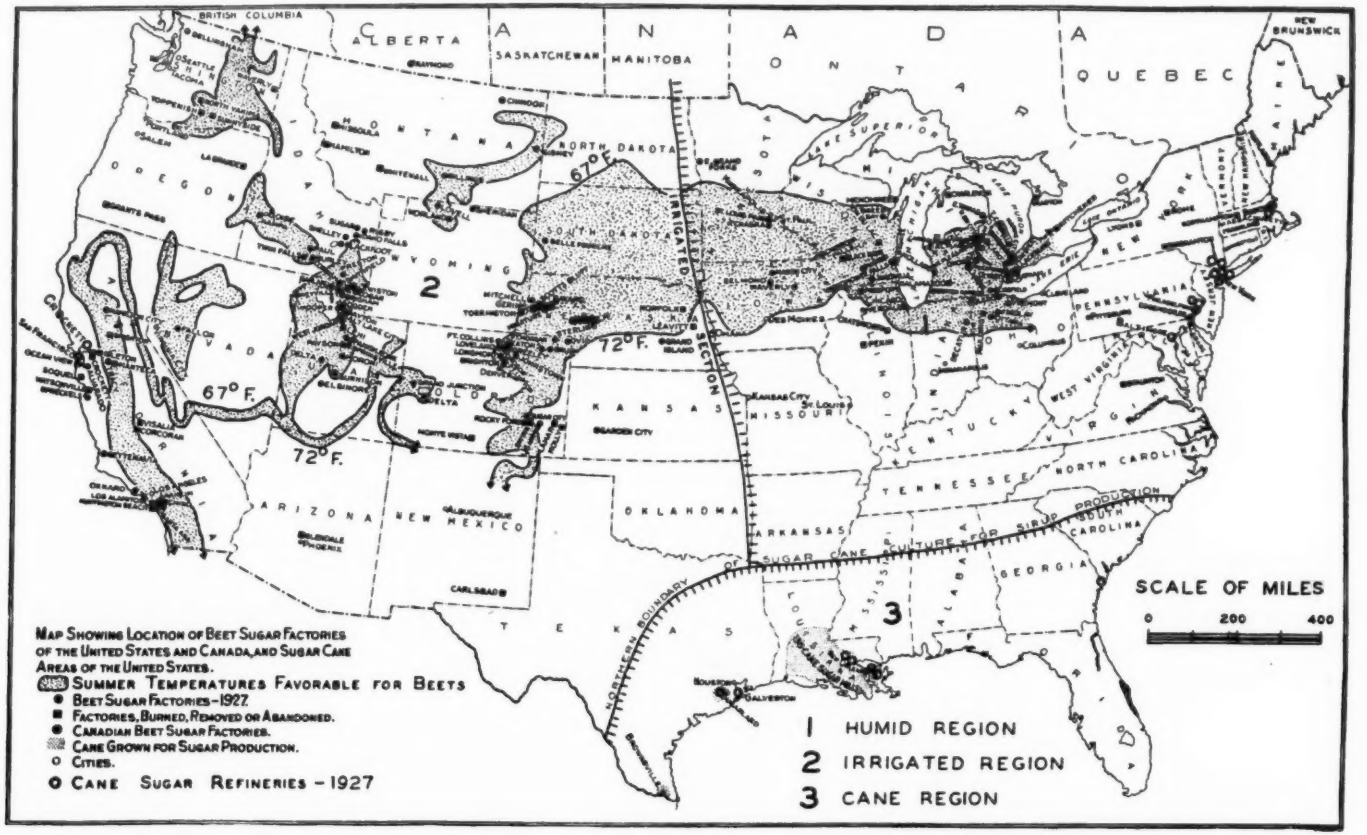

FIG. 1. A map showing the sugar beet region and the sugar cane region of the United States together with the distribution of factories and refineries. The major portion of beet culture is found between the mean summer isotherms of 67° F. and 72° F. Production is widely scattered thruout the Irrigated Region of the Western States on account of the high relief, distribution of suitable beet lands and the available supply of water for irrigation. The beet factories are located in the producing area, whereas the cane refineries are at tide water. The large number of abandoned beet sugar factories indicates consolidation. After U. S. Sugar Beet Association and U.S.D.A.

Geographical Influences on Sugar Production in Continental United States

The environmental complex suitable to the cultivation of sugar in continental United States under present economic conditions is confined to a comparatively small land area widely scattered thruout the north-central, western, and southwestern states (Fig. 1). About two-tenths of 1 per cent of the 357 million acres devoted to crops in 1927 was given over to the cultivation of sugar. The United States has vast areas of agricultural land partially adapted to the cultivation of the sugar beet or cane. However, when all natural forms and the position with regard to marketing are considered in the light of a favorable environmental complex which will permit the successful cultivation of the sugar beet or cane in a given locality, the productive area dwindles to a mere 800,000 acres, of which about 675,000 acres are beet lands. The irrigated districts of the Western States have 73 per cent of the continental production, whereas the humid districts of the North Central States produce 19 per cent, all of which is beet sugar. The districts of the Gulf Coastal Plain provide 8 per cent of the total in the form of cane sugar.[1] Domestic production, excluding possessions, amounted to 1,168,000 short tons, or 22.7 per cent of our total supply during the period 1917-22. The geographic influences on production are essentially similar within each region where a typical sugar-producing complex is apparent. The high cost of labor in the United States tends to offset the geographic advantages to the extent that governmental tariff regulations are essential in order to maintain production within our continental borders.

Beet Culture in the Humid Region of the North Central United States

The sugar beets of the Humid Region are produced about the lower Great Lakes on the dark, fertile silt and clay loams of the level glacial lake plains or gently rolling marginal lands, and on similar soils in smaller districts of Minnesota, Iowa and Wisconsin. The district comprising the Saginaw Valley, the Thumb, and the Erie Lowlands of southeastern Michigan, which extends thru northwestern Ohio towards Fort Wayne, Indiana, is the outstanding center of culture having twenty-one of the thirty-four sugar

[1] U. S. Department of Agriculture, Year Books, 1920-27

whereas the cane refineries are at tide water. The large number of abandoned beet sugar factories indicates consolidation.
After U. S. Sugar Beet Association and U.S.D.A.

factories operated in the Humid Region. The loose loamy soils of the lake plains permit root crops to expand freely, and, with plenty of sunshine during the growing season, together with the soil moisture regulated by ample rainfall and good drainage, a large root without prongs is developed yielding a satisfactory tonnage with high sugar content.[2] The most successful beet districts are between the mean summer isotherm of 67° F., which extends from the Thumb of Michigan across central Minnesota, and the isotherm of 72° F., extending thru central Ohio toward middle Iowa (Fig. 1). This belt has a well distributed supply of moisture with two to four inches of rainfall per month, warm weather during the early and middle portions of the five-month growing season required for the sugar beet, and cool weather with less moisture and a large diurnal variation in temperature during the ripening season.

FARM PRACTICES

Beet culture in the Humid Region is confined to small fields distributed among a great number of farms varying in size from 25 to 240 acres or more. The intensive nature of root cropping, the need of a three or four year crop rotation scheme, the great labor requirements of sugar beet production and the small average farm holdings in the North Central States, confine the beet acreage between about four to thirty acres per farm. The average acreage per farm increases from east to west, especially in Iowa and the irrigated sections of the Western States. In Michigan the average farm hauling distance is two and a half miles, indicating that the beet fields are concentrated along the railroads leading to the factory centers. Where natural conditions will permit, the sugar companies contract for the beet crop over areas having a radius of forty miles. The motor transport has extended the industry farther from the railroads in many localities since longer hauls can be made in less time without retarding the harvesting and marketing performance.

Sugar beets are exacting in their requirements for normal growth. Steep slopes cannot be utilized for sugar beets as the soil is likely to wash away from the plant, exposing the root to the light, causing a woody texture in the exposed portion, a low sucrose

[2] Stilgenbauer, F. A., The Michigan Sugar Beet Industry, *Economic Geography*, Vol. 3, (1927), pp. 499-501

content and complicated sugar extraction.[3] Rich soils are necessary to produce fiber sufficient for a large plant. The beet is an air feeder and consequently a large and healthy plant will produce the most sugar from the atmosphere in the presence of normal sunshine and moisture conditions. Extremely high temperatures during the growing season are injurious to the plants. Whenever the temperature goes above 70° F. the sucrose content decreases. The sugar accumulates most rapidly during the cool fall. Beets are often harvested without loss after the ground becomes slightly frozen. The sucrose in the beet increases directly with the amount of sunlight, whereas the tonnage is increased with ample heat, moisture and plant food. Heavy rainfall near the harvest season

FIG. 2. A large field of sugar beets on the rich level prairie lands near Waverly, Iowa. Cultivating and hoeing are continued until the leaves completely obscure the ground. For good tillage and freedom from weeds the farmer is repaid with increased tonnage, higher sugar content and lower tare. U. S. Sugar Beet Association.

in October increases the sap and lowers the sugar content. The farmers thoroly drain the beet fields in order to prepare an early seed bed, warm the seed bed by decreasing evaporation, increase the feeding area of the plant by lowering the water table, permit cultivating and weeding at all times, prevent the destruction of soil structure at time of harvest and allow the root to develop without prongs which otherwise increases the tare.[4] The ground is plowed to a depth of seven to nine inches to further insure normal growth. Sugar beets benefit the soil by correcting the structure

[3] Loc. cit.

[4] Robey, O. E., "Tile Drainage." Address before the Sugar Beet Institute, 1924, East Lansing, Michigan

and adding to the fertility thru the decomposition of the extensive hair-like root system which remains in the ground after the harvest.

In the growing of sugar beets the common farm implements are employed together with specialized tools such as the beet drill, cultivator, lifter and hauling rack. After the ground is thoroly prepared in the spring the seed is planted with a drill sowing four rows at a time spaced 18 to 22 inches apart. The grower tills the soil extra well and drills straight so that plants will not be torn out or injured during the cultivating operation which begins as soon as the plants make their appearance above ground. Straight rows are obtained only on comparatively level well-tilled

FIG. 3. Harvesting sugar beets for the Great Western Sugar Company of Colorado. Note the lifting, topping and hauling operations. The roots are large and perfect in shape with good tillage and irrigation.

land. The beets are blocked and thinned when an inch or so tall allowing one plant to remain at intervals of 10 or 12 inches in the row. Careful thinning, hoeing and cultivating are necessary in order to guarantee a good stand (Fig. 2). Cultivation with occasional hoeing goes on until the leaves cover the ground after which the crop is laid by until ripe. As soon as the sugar content is greater than 12 per cent and the purity coefficient is 80 per cent or more, generally indicated by the lower leaves turning brown, the beet is ripe and ready for the harvest. The roots are loosened and slightly raised in the soil with the beet lifter, pulled by hand and thrown into piles or circular winrows (Fig. 3).

Twelve to twenty rows are used for a winrow. The tops are removed by one stroke of a sharp heavy knife and the roots thrown into a pile at the center of the circle to be covered with the tops in order to prevent shrinkage from evaporation unless marketed at once. The beets are then hauled to the sugar factory, or to the loading station along the railroad, where they remain in huge piles awaiting the manufacturing process (Fig. 4). The roots are not injured materially by freezing, but alternate freezing and thawing makes sugar extraction difficult. The roots are placed in great piles at the factory to minimize the damage resulting from freezing and thawing.

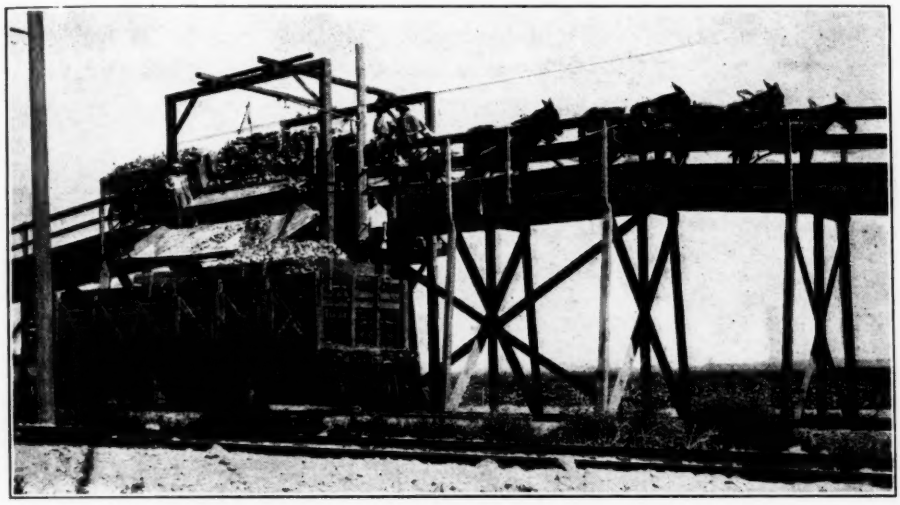

FIG. 4. Dumping beets on railway cars for the Southern California Sugar Company of Santa Ana. The roots are weighed and tared before reloading. Courtesy of T. G. Palmer.

The sugar plant is not without enemies. The root rot and leaf spot are common fungus diseases.[5] Curly-top and the sugar-beet wilt are prevalent only in the Irrigated Region of the Western States. Among the injurious insects are the sugar-beet webworm, beet army worm, beet leaf beetle, the sugar-beet leaf hopper, beet root aphid, the false chinch bug and the cutworm. Paris green, arsenic, Bordeaux mixture, crop rotation and irrigation are effective remedies.

[5] Sugar, Bul. No. 893, pp. 53-56. Bu. of Plant Industry, U. S. Dept. of Agr., Washington, D.C., 1923

The sugar beet factory is surrounded with beet fields. The great bulk necessitates the localization of factories at the source of raw material and at focal points on lines of transportation where a large supply of clean water is available.[6] A sugar factory with a daily slicing capacity of 1000 tons, the average for all factories in the United States, requires two and one-half to three million gallons of water per day (Fig. 5). The beets are floated from the bins in flumes and elevated to the washer, sliced into long slender pieces, sent to the diffusion batteries where the raw juice is extracted with warm water, pressed from the fiber and the pulp residue elevated to the driers to be prepared for stock food

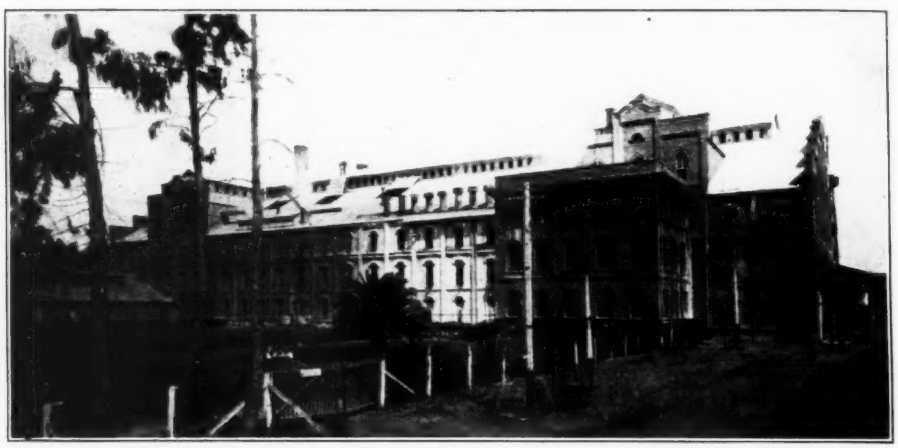

FIG. 5. The American Beet Sugar Company Plant at Oxnard, California, one of the two largest beet sugar factories in America with a daily capacity of 3,000 tons of beets, represents a capital outlay of $6,000,000 and consumes 16,000 acres of roots annually. U. S. Beet Sugar Assoc.

(Fig. 6). The juice is then filtered, treated with carbonic acid gas, evaporated in partial vacuum, crystalized, washed, dried and bagged or barreled for market.[7] The size of crystal is regulated at the crystalizer in order to meet the demands of trade. If properly manufactured, beet, cane and other sugars made from sucrose are identical in chemical and physical properties.

The by-products of sugar manufacture make the association of a live stock industry imperative. Beet tops and leaves, dried

[6] Stilgenbauer, F. A., op. cit., pp. 502-503

[7] Palmer, T. G., Sugar Beet Industry of the United States, pp. 25-44. Union Trust Bldg., Washington, D.C.

pulp and molasses residue are valuable and nutritious foods for beef cattle, dairy cattle and sheep. The tops are pastured on the field or ensiled for future use. The by-products from the farms

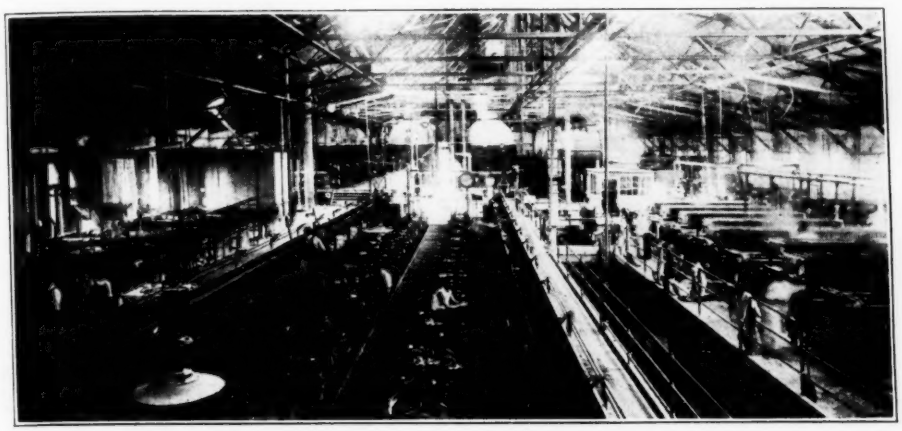

FIG. 6. A view of the Straight Line Diffusion Battery where the raw juice is extracted from the pulp, filtered and reduced to 15 per cent in richness. This is but a small part of the expensive large scale machinery needed for the manufacture of sugar. Courtesy of T. G. Palmer.

in the Humid Region are marketed in the Dairy Districts roundabout. Large stock ranches utilize the pulp from the western

FIG. 7. Cattle feeding on beet pulp at a large ranch operated by the Union Sugar Company at Betteravia, California. The pulp from the factories of the Humid Region is consumed at small stock farms roundabout. U. S. Sugar Beet Assoc.

factories on a large scale (Fig. 7). These ranches are often owned by the sugar companies. Molasses is made into alcohol and the lime residue is sold for fertilizer and soil sweetening application.

THE IRRIGATED REGION

The Irrigated Region produces nearly three-fourths of the domestic sugar supply of the United States excluding possessions. Climate and soil differences make production of sugar in the western states unlike that of the Humid Region.[8] The states lying west of the 100th meridian have a seasonal deficiency of rainfall in most areas where soil and other natural forms are favorable to the culture of sugar. Hence twelve of the nineteen states producing beet sugar have to resort to irrigation which confines production to fertile valleys and small plains having an available supply of water in surface streams. The irrigated beet lands have a great variety of soils ranging from distinctly sandy types thru the sandy, silty and clayey loams to volcanic ash and heavy black adobe. In the arid districts high dust-laden winds not only increase evaporation from the soil but destroy the crop by cutting and burying the young plants.

The fields in the Irrigated Region are plowed to a depth of ten to fourteen inches to permit normal root development and the free circulation of soil air and moisture. The normal precipitation altho small is conserved and the irrigating waters are used merely to carry the crop past the droughts. Planting is delayed until the frost danger in the valley is past to avoid injury to the tender young plants which soon become hardy and frost resisting. The ground is irrigated before and after planting by making corrugations five or six inches deep and twenty to forty inches apart or between the rows. After the ground is thoroly wet the land is cultivated as soon as convenient in order to destroy weeds and conserve the moisture. Corrugators are attached behind the cultivators to prepare for the next irrigation operation. The beet field is never completely flooded to prevent incrustation of the soil and scalding of the tender plants in the presence of hot sun and superfluous water. The farmer makes cultivation take the place of irrigation as much as possible so that soil alkalinity will be retarded. Soil alkalinity is corrected by flushing the land occasionally. Irrigation is controlled by the condition of the plant in each specific locality and requires considerable skill to avoid damaging results from scalding, incrustation and alkalinity. The

[8] Townsend, C. O., Sugar Beet Growing under Irrigation, U. S. Dept. of Ag., Farmers' Bull. No. 567, 1918, pp. 1-23

greater amount of sunshine under rainless skies and the proper moisture conditions regulated by irrigation and drainage give the western states an advantage in tonnage and sugar yield per acre. The average refined sugar yield during 1925-26 was for Colorado, one and seventy-three hundredths short tons per acre; for California, one and twenty-eight hundredths tons; for Michigan, one and fifteen hundredths tons and for Ohio, seventy-seven hundredths tons. In 1926, the western states produced approximately 725,000 short tons of refined sugar, while the humid section produced 172,000 tons. Other practices of the Irrigated Region are not unlike those performed in the Humid Region.

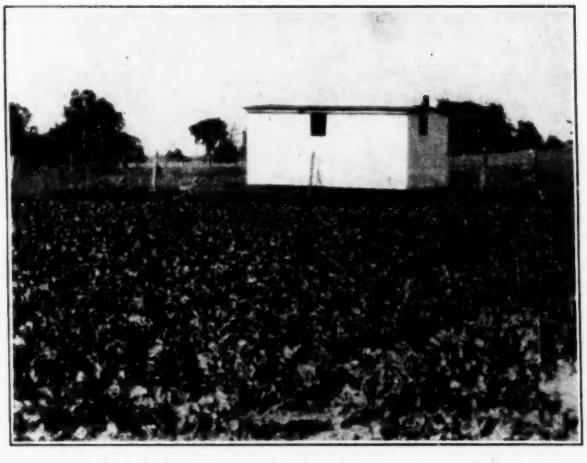

FIG. 8. Many of the laborers in the Michigan beet fields live in small temporary homes which are readily transported from one locality to another.

LABOR

The labor problem of sugar beet culture is solved by a careful co-operation between the grower and the manufacturer. Sugar beets require six times as much labor as corn. The farmer, who grows beets under contract with the sugar companies, is compelled to secure his labor with the aid of the manufacturer. The contract stipulates that the grower shall do the planting, cultivating, lifting and hauling; whereas the blocking, thinning, hoeing and topping are performed by the contract labor. A few farmers find it convenient to perform all of the labor function. The representatives of the sugar companies secure the required labor from the industrial centers or from foreign countries, supervise their moving and provide temporary homes during the beet season

(Fig. 8). If the farmer is not amply supplied with working capital, the sugar companies advance cash to the laborers for duties performed, or to the farmers for beet seed, fertilizer and implements, deducting these advances from the farmer's credit for beets delivered. In the Humid Region most of the laborers are secured in the industrial centers. The Mexican labor generally used in the Irrigated Region is found to some extent in the North Central States, and child labor is still evident in all districts (Fig 9). Labor organizations exaggerate the harmful effects of child labor

FIG. 9. Blocking and thinning young sugar beets in a level valley at the base of the Rocky Mountains near Denver, Colorado. Mexican labor is characteristic of the Western States. The children do not appear to be sickly or over-worked. U. S. Sugar Beet Assoc.

in the beet industry. Personal observation shows that the child labor conditions are not so tragic as the literature of these organizations would have the reader believe. They fail to consider (1) that the standard of living among the beet-field class of contract labor is naturally low and cannot be placed on a par with that of the average American, (2) that America means opportunity to the laborer of foreign birth, and (3) that honest hard work is the pathway to good citizenship and the guiding hand of American industrial prosperity.

The Cane Region of Continental United States

Cane is produced in southeastern United States as far north as southern Arkansas and North Carolina, and as far west as central Texas. The cane sugar production is confined to the level alluvial bottom lands of fertile silty loams and stiff clays in the Lower Mississippi Valley comprising most of the southern half of the state of Louisiana.[9] Small outlying districts are found on the Gulf Coastal Plain of Texas, whereas the vast remaining area is devoted to the production of sirup. The climate is not ideal for cane sugar production in the United States altho other natural factors are favorable, but the high protective tariff on imported refined sugar enables the plantation owner to stand the risk of a killing frost which prevents the cane from reaching maturity. Sugar cane requires a uniformly high temperature to keep the plant growing rapidly. Cool, dry weather with less sunshine is advantageous during ripening. Louisiana is often subjected to freezing temperatures beginning in late November or early December. The natural drainage is inadequate on the low flat lands of the lower Mississippi Valley. Other natural conditions are favorable to the production of sugar cane.

In Louisiana the ground is plowed in the fall and again before the spring planting of late February or early March. Planting is also done in October and November with spring and fall plowings. The soil is thoroly tilled and furrowed in rows six feet apart. Since cane has lost its power to seed in its native tropical habitat, propagation is effected by placing in the furrow, cuttings of the stalk each containing a node. The cuttings which are placed in parallels to guarantee a good stand when the sprouts stool out, are covered with three to five inches of soil by a plow and rolled with a heavy roller. When sprouts appear from the nodes all the dirt is removed with a plow and hoe (Fig. 10). The ground is cultivated and treated with commercial, tankage or cottonseed fertilizer until the cane is large enough to be laid by. The middle of the row is plowed deep the last time to insure good drainage until the harvest.

On account of the unfavorable climatic conditions but two crops of cane are obtained from one planting, the first known as "plant

[9] The Cane Sugar Industry, Mis. Bul. No. 53, pp. 293-318. U. S. Dept. of Commerce, Washington, D.C. 1917.

cane'' and the second as ''stubble'' or ''ratoon cane.'' The cane is harvested before the frost in November to prevent losses thru souring. When the first ratoon has been removed the field is broken up for corn and cow-peas to be followed the fourth year with plant cane. At harvest time the cane is stripped of its leaves, cut with a sharp knife at a daily rate of three tons per person, loaded by mechanical loaders into wagons of one and one-half to two tons capacity drawn by mules, hoisted into railway cars by derricks and transported to the sugar mill where the raw sugar is made. In 1927, a total of 150 sugar mills were in operation thruout Louisiana. Six refineries located in the larger centers

FIG. 10. A field of young plant cane on a Cuban plantation. The sprouts stool out in the same manner as wheat. Pan American Union.

like New Orleans and Texas City finish the raw sugar of the mills. Negro men, women and children perform the greater share of the labor function on the plantations and at the mill. Sugar production is on the decline in Louisiana on account of the keen competition from more favorable tropical areas. The average production of 338,000 short tons in 1909-11 has declined to 88,000 short tons in 1925-27.

CANE SUGAR FROM OUR INSULAR POSSESSIONS AND NEARBY TROPICAL FOREIGN LANDS

Our insular possessions contribute nearly one-fourth of the sugar annually consumed in the United States, or an amount equal

to the continental production within the country, while foreign tropical lands furnish eleven-twentieths of the supply. During the period 1918-22, the Hawaiian Islands provided 11.4 per cent; Porto Rico, 8.2 per cent; the Philippines, 2.7 per cent; Cuba, 50 per cent and the Dominican Republic, Central and South America, Java, etc., 5 per cent of the total supply which amounted to an average of approximately 5.6 million short tons. The foregoing percentages were calculated after allowance was made for the sugar exported from the United States. The more intensive methods employed in the Hawaiian Islands are worthy of consideration in contrast to the somewhat unsystematic practices in the West Indies as represented by Cuba.

Hawaiian Cane Sugar

The Hawaiian Islands are under the influence of the Trade Winds for nine months of the year. Volcanic mountains rise to a maximum elevation of 13,825 feet and the warm trades are forced upward to cool and drop their moisture on the northeast facing slopes where the rainfall often exceeds 260 inches per year, whereas the leeward slopes are deficient in precipitation. The islands have an abundance of sunshine and humid heat as indicated by an average temperature of 71°F. The soils are decomposed basaltic lavas containing large quantities of iron and lime, as well as smaller amounts of potash and phosphate. The volcanic ash and weathered soil material is washed into the valleys and toward the sea by the heavy rains where it is generally held in place by the fringing coral reef. The slopes and valleys furnish ideal drainage and irrigation conditions for the culture of sugar.

Sugar is grown by the plantation method on the central plains and sloping coastal lands of Oahu and Maui, on the windward slopes of Hawaii up to 1000 feet elevation,[10] and on the coast and valley lands of Kauai (Fig. 11). In 1927, a total of fifty-two sugar plantations of which Hawaii had twenty-four; Kauai, eleven; Oahu, eleven; and Maiu, six were in operation. Approximately 235,000 acres are in cane each year, more than half cultivated under irrigation, and 122,000 acres are harvested yielding 790,000 short tons of raw sugar. About 50,000 laborers consisting for the most part of Japanese, Portuguese, Hawaiians, Filipinos, Koreans and

[10] Freeman, O. W., The Peopling of Hawaii, *J. of Geog.*, Vol. 37, 1928, pp. 133-134

Porto Ricans, perform the labor function and live in the forty-seven plantation villages near the coast.

Cane culture is more intensive in the Hawaiian Islands than in any other part of the world. Plowing and furrowing are done with powerful steam engines which work in pairs to pull a gang-plow back and forth across the field with wire cables.[11] Mule plowing is done where the steam plows cannot operate because of land surface conditions. The soil is broken and pulverized to depths

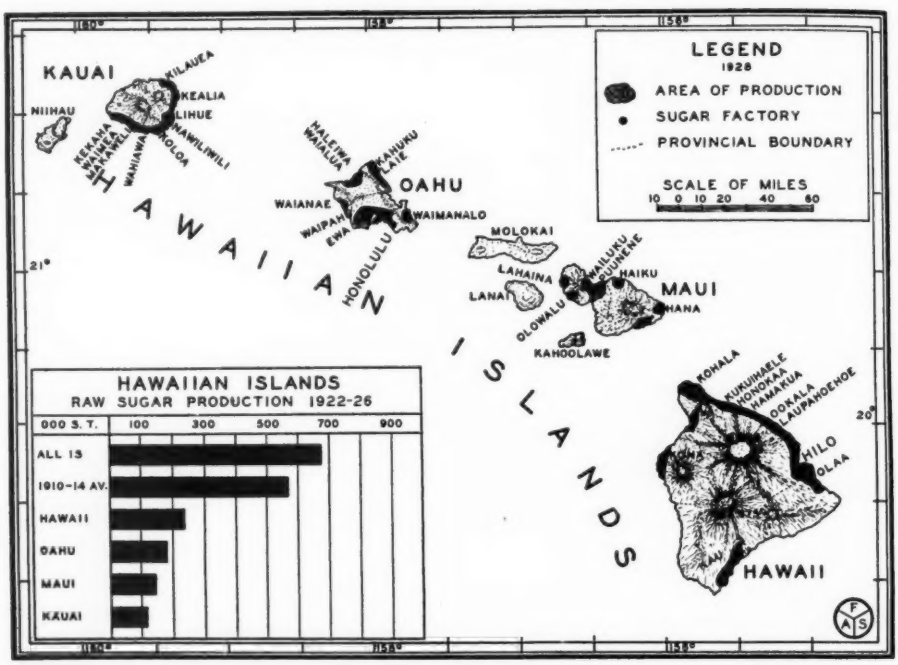

FIG. 11. In the Hawaiian Islands a total of 52 sugar plantations yield an average of 675,000 short tons of raw sugar annually all of which is sent to the refineries of San Francisco. Note the distribution of the plantations along the coast and on the central plains.

ranging from eighteen to thirty-six inches. In the semi-arid districts double-deck moleboard plows make the furrows for irrigation according to the slope of the land. The water is conducted from the main ditch to lateral ditches and thence to the furrows placed at five-foot intervals. Rivers, artificial ditches and tunnels carry the irrigation waters from great bogs and reservoirs in the mountains. In the more intensive operation of raising cane under

[11] U. S. Dept. of Commerce, op. cit., pp. 69-128

irrigation the cultivation is done with hand implements, but power cultivators are used on the unirrigated plantations. In the production of short ratoons the cane is cut back early in the year so that it will flower and mature in twelve months. In long ratoons the cutting back is done in June and the flowering is carried over to the following season giving the plant seventeen to eighteen months of growth resulting in yields as high as 100 tons of cane per acre. About six tons of cane yield one ton of raw sugar. The soil is yearly enriched with large quantities of manure, mill waste and commercial fertilizer altho most of the lands are naturally fertile. When the cane is ripe the dead leaves which have not already fallen are removed and burned so the cutter will have to handle only pure cane. This practice is considered more economical than to allow the leaves to remain on the field for fertilizer, to create a fire hazard and to interfere with harvesting as in Cuba. After the plant is removed the stubs are covered with four or five inches of earth and the new sprouts of the first ratoons soon appear. Hawaiian cane is seldom allowed to go beyond the second ratoons as the cane is improved and better yields are obtained from frequent plantings.

The cane is transported to the mills by wagons, sleds, flumes and narrow gauge railroads. If fields are level the railroad is generally used, but if the slopes are more than 5 per cent, V-shaped wooden flumes on tressels are employed. The overflow water is utilized to generate hydro-electric power for factory or irrigation use. Cane stalks and molasses residue mixed with fuel oil furnish much of the power at the mills. The manufacture of the raw sugar at the mill is not unlike that previously considered. The filter-press cake being rich in nitrogen and phosphate is spread on the lands. The sugar factories are located at or near the coast where the raw product is collected by freighters of the Matson Navigation Company, specializing in the sugar trade, transported to the refineries at San Francisco and Crockett, California, entering the wholesale trade of the United States as far east as Chicago in competition to Cuban sugar. The California and Hawaiian Sugar Refining Corporation plant at Crockett, the largest refinery in the world with a capacity of 750,000 tons per year, is operated by 33 Hawaiian plantations.[12] The entire output

[12] California and Hawaiian Sugar Refining Corporation, Something About Sugar, pp. 12-13. Crockett, California, 1925.

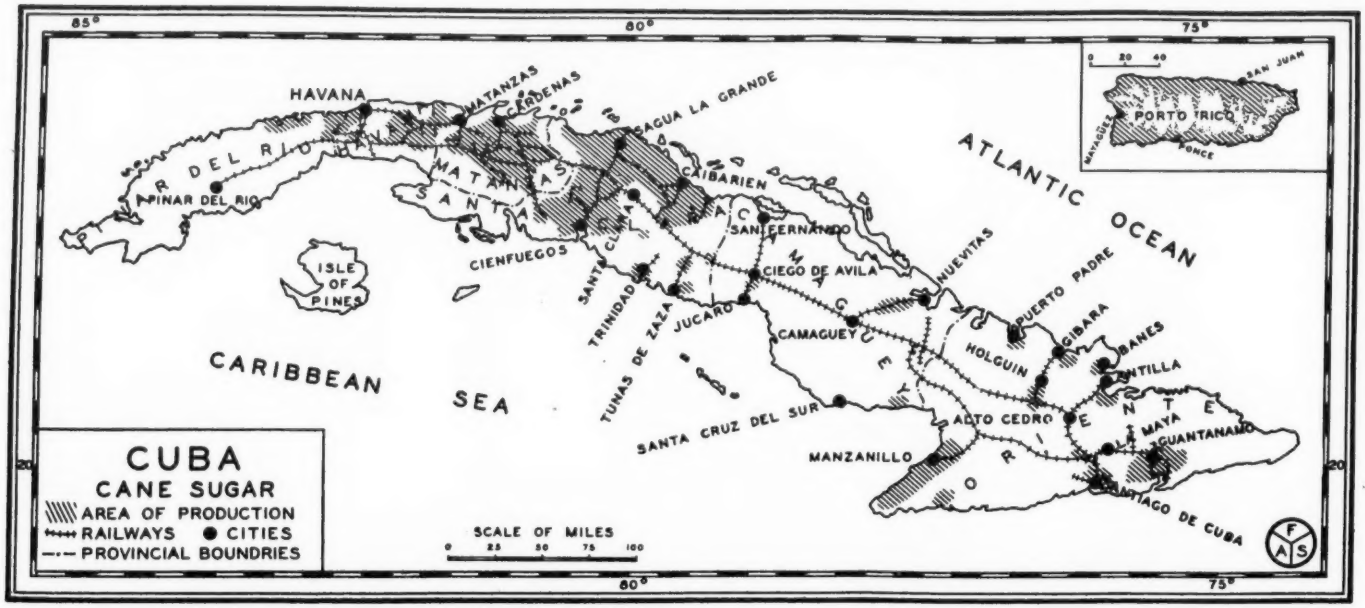

FIG. 12. Cuba may well be called the sugar bowl of the United States. Eastern Pinar del Rio, Habana, Matanzas, Santa Clara and Oriente are the leading sugar provinces. Note the large number of ports along the coast exporting raw sugar to the refineries of the Atlantic and Gulf Coasts of the United States. After H. C. Prinsen Geerligs.

of Hawaiian raw sugar is finished in the California refineries and consumed in the United States.

Cuba as the Sugar Bowl of the United States

Cuba is the chief source of sugar destined for United States consumption. More than half of the sugar actually consumed in the United States is annually imported from the numerous ports along the coast of Cuba (Fig. 12). The sugar is received in the raw state at New York, Boston, Philadelphia, Baltimore, Savannah, New Orleans and elsewhere; finished in refineries at tidewater, and distributed by rail to the wholesale and retail centers of the country. Cuba has become the sugar bowl of the United States (1) because favorable natural conditions permit the production of cane sugar at a lower cost per ton than in any other area of the world, (2) the United States Government has encouraged production by granting a preferential duty on sugar imported from the island, and (3) the nearness of production to the densely populated eastern half of the United States, where the major portion of the Cuban sugar is consumed, has favored the marketing performance.

Cane Sugar Production in Cuba

The foundation rocks of Cuba are of pre-Tertiary sedimentary origin. Above this are littoral beds composed of terrigenous material followed by a great thickness of white limestone consisting of organically derived oceanic material. The land surface in the provinces of Pinar del Rio and Oriente is irregular due to the presence of well defined ranges of mountains reaching an elevation of 2500 feet in the former and 8,322 feet in the latter. The north coast is for the most part steep and rocky, and in the provinces of Matanzas, Santa Clara and Camaguey, it is bordered by islands and reefs of coral formation resulting in a partial barrier to navigation. The central provinces consist mainly of broad rolling plains with shallow stream valleys. The climate of Cuba is tropical and distinctly marine in regard to humidity and temperature ranges. The mean annual temperature is 77°F. and the mean relative humidity is 75 per cent. Temperatures below 50°F. and above 90°F. are rare. The rainfall along the north coast is about fifty inches, the south coast forty-five inches and the interior

windward slopes sixty inches. Natural drainage is inadequate on the level plains and valley bottoms where rainfall is heaviest. The best sugar soils are the red lands of Habana, Matanzas and eastern Pinar del Rio. These lands are sticky when wet and difficult to cultivate, but allow the water to pass freely to natural underground drainage in the cavernous limestone. Black soils with calcareous subsoils in the hill districts of the island and black soils with impervious clay subsoil on the level plains give good sugar yields under normal climatic conditions.

The Colono System of cultivation is in operation on the plantation lands of Cuba. About 80 per cent of the cane production is

FIG. 13. The typical bull-cart of the West Indian sugar plantations has a high rack to receive the sized cane and is drawn by two yoke of bulls. The high wheels and the split-hoofed bulls are indispensable on the muddy plantations of Cuba. The cane leaves are left for fertilizer but constitute a serious fire hazard. Pan American Union.

planted, cultivated and harvested by a large number of farmers called Colonos. Some cultivate their own land, others rent company land or lease from a third party. The sugar companies divide the cane acreage among a great number of Colonos in order to get better fire protection and labor services.[13] Each Colono carelessly plants and cultivates a large acreage of cane and the surplus is held over to the following year without deterioration. By this practice the mills can manufacture all the sugar the foreign market will absorb. More than 20 ratoons have been taken from one planting with only a comparatively small amount of fertiliza-

[13] U. S. Dept. of Commerce, op. cit., pp. 249-381

tion other than the decomposition of the leaves and stalks of former crops. The laborers, most of which are Jamaicans and other West Indian Negroes, use a go-as-you-please system of har-

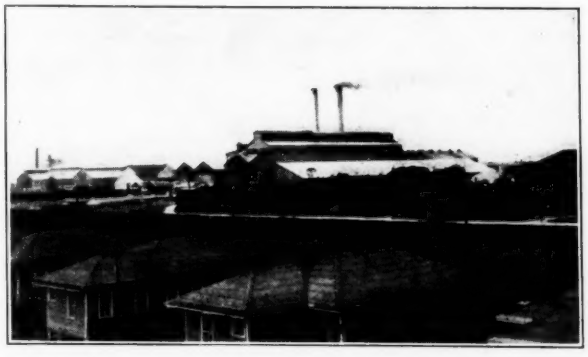

FIG. 14. A Cuban Sugar Mill of the United Fruit Company showing the plantation home of the laborer and the narrow gauge railway cars which transport the cane to the mill. Pan American Union.

vest by following the shade of the standing cane when cutting.[14] Bull carts with wheels eight to nine feet in diameter drawn by two

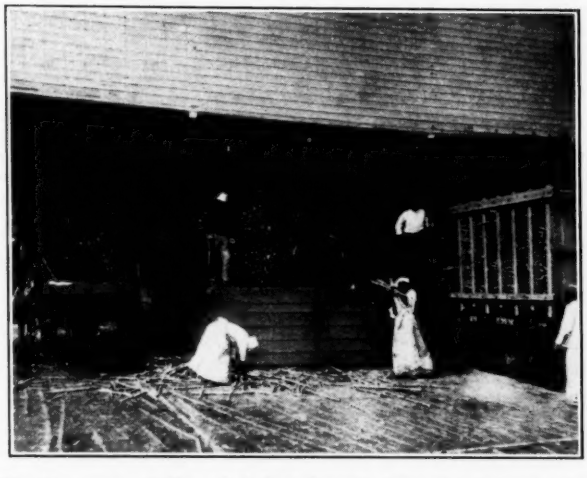

FIG. 15. Placing cane stalks of 4-foot length into the hopper at a Cuban Sugar Mill. Cane is brought to the mill on bull-carts from nearby areas. Negroes perform most of the labor about the mills and plantations. Pan American Union.

ox-teams carry the cane to the narrow guage railroad or to the sugar mill (Figs. 13, 14, 15). On the average one cart and two

[14] Sugar Making in Cuba, Commodities of Commerce Series, No. 13 (1927), pp. 4-7. Pan American Union, Washington, D.C.

yoke of bulls transport six tons of cane per day. The cane fields become very muddy after heavy rains and the large wheels are

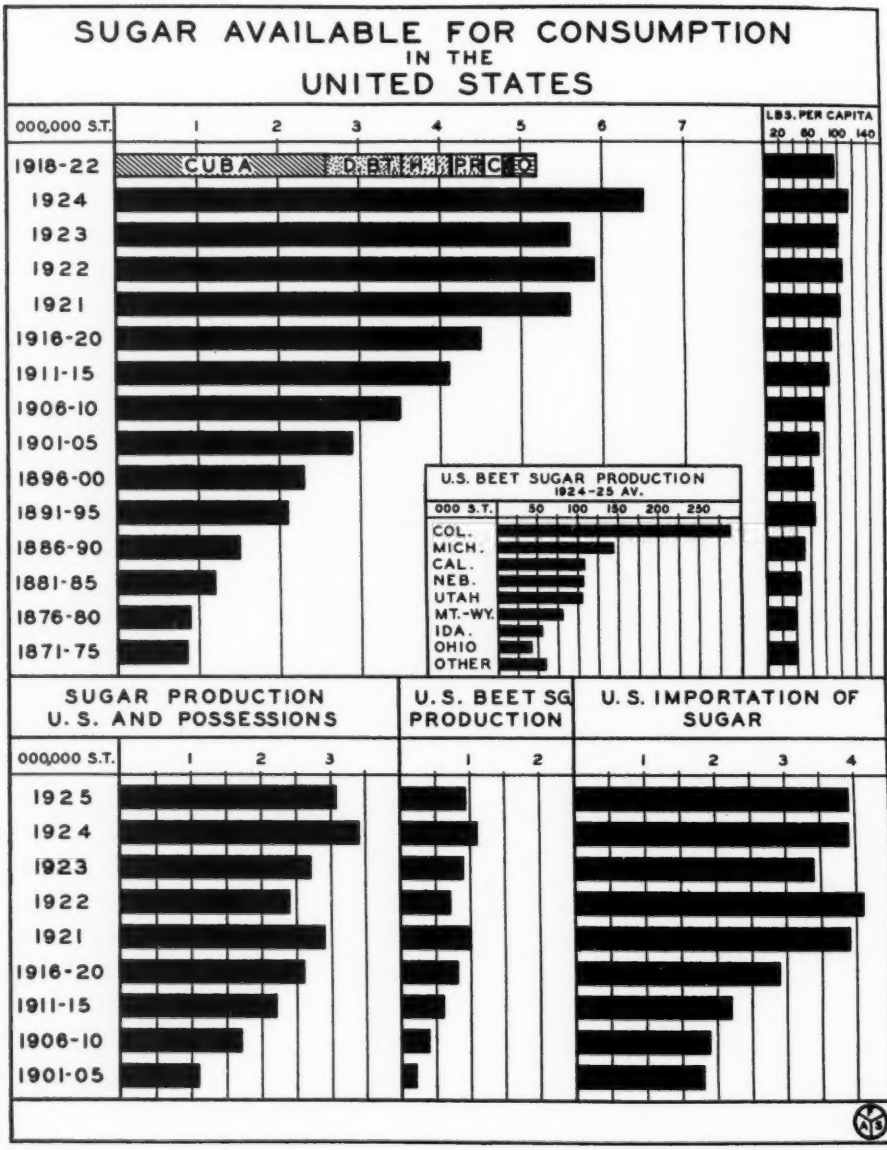

FIG. 16. A graphic representation of the sugar available for consumption, the per capita consumption and the source of supply for the United States.

necessary to carry the cart thru the ruts and mudholes. Altho the system of culture and transportation is haphazard and crude,

this method has proven to be the most economical under present natural conditions. Cuba is the largest and cheapest cane sugar producing center of the world and has a reputation for the worst system of cultivation.

In 1925, Cuba produced approximately 5,523,000 short tons of raw sugar exporting about 3,773,000 short tons to the United States. During the same year the total supply of sugar in the United States amounted to 7,115,000 short tons (Fig. 16). The raw sugar is exported from Matanzas, Cardenas, Cienfuegos, Nipe, Habana and numerous other ports along the coast of Cuba to the refineries along the Atlantic and Gulf Coasts of the United

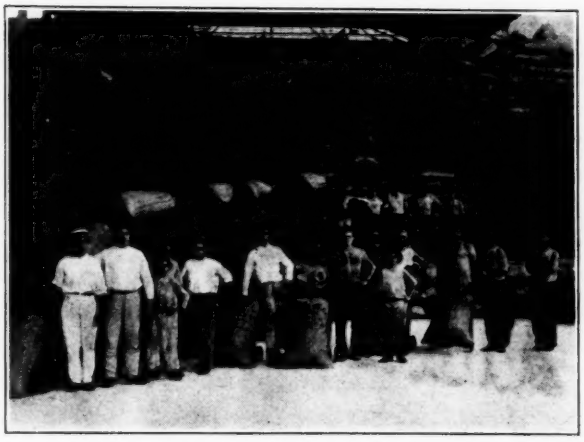

FIG. 17. Large scale machinery is utilized in the storing and shipping of raw sugar. The sugar industry provides a market for jute bags from England and India. Pan American Union.

States (Fig. 17). The larger portion of Cuban raw sugar is carried by freighters making a special business of this type of trade. In 1919, the eastern refineries received 2,824,000 long tons and the southern refineries 662,000 long tons.[15] The western refineries received 412,500 long tons of Hawaiian sugar. The six refineries of Greater New York manufactured 1,851,000 long tons of cane sugar having the advantage in position to receive raw sugar by boat and to distribute the refined sugar to the centers of consumption.

[15] Bernhard, J., A Statistical Survey of the Sugar Industry and Trade of the United States, pp. 1-20. 1919.

CONCLUSIONS

The United States is one of the foremost sugar consuming countries of the world. The per capita consumption has increased in terms of refined sugar from 37.2 pounds in 1870 to 106.8 pounds in 1925. The great importance of sugar as a food has influenced the government to encourage by tariff regulation the production of nearly one-fourth of our sugar in continental United States, about one-fourth in our insular possessions and the remainder in nearby lands with Cuba the chief source of foreign supply. The surplus system of cane cultivation on a plantation basis enables the Cuban growers to provide all the sugar the American market will absorb beyond domestic and insular production. A higher tariff would result in a larger home production, whereas little or no tariff would completely ruin domestic production. The government aims to fix the tariff so that enough sugar will be produced at home to guarantee a safe margin in time of war, and so that the remainder will be produced as cheaply as possible and as near the United States as natural conditions will permit. The high tariff on imported refined sugar eliminates undesirable foreign competition and encourages the importation of raw cane sugar to be refined by American refineries at our major entrepôt ports which are most favorably located for importation and redistribution. Hence, American interests control the major portion of the sugar entering the United States.

RECENT TRENDS IN MINERAL PRODUCTION

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With the constantly increasing importance of minerals in the last few years there has been greater interest in the question, Where are the various minerals being produced? Which countries are leading in the production of iron ore at the present time? Which lead in the production of petroleum? Which lead in the output of the other important mineral commodities? For these matters a knowledge of conditions ten years ago, or five years ago, or, in some cases, even a year ago will not suffice.

In 1921 the United States Geological Survey issued its World Atlas of Commercial Geology which presents graphically and other-

wise the sources of the most important minerals. Later information may be obtained from various sources.[1] It is the writer's purpose to summarize the subject of the recent and present trends in the production of a group of outstanding mineral commodities: iron, coal, petroleum, copper, lead, zinc, gold, silver, platinum, and tin.

The information in the various grafs and discussions is the latest available at time of writing. The sources are various but are principally those referred to above. It should be understood thruout that figures for 1926 and later are only estimates, and that for some data for years earlier than 1926 estimates had to be used. For entirely reliable statistics regarding the various minerals it is necessary to wait a number of years. In the meantime the sources of the production of certain of the mineral commodities are shifting and the relative rank of the various countries in their production is changing. The present attempt is to present a picture of conditions as nearly up-to-date as possible making it as accurate as information will permit.

Iron

According to figures from the United States Bureau of Mines the sources of the world's iron ore for 1925[2] were as follows:

	Approximate per cent of total		*Approximate per cent of total*
United States	41.7	Austria	.7
France	23.6	Newfoundland	.6
Great Britain	6.8	Morocco (Spanish)	.5
Sweden	5.4	Tunis	.5
Luxemburg	4.4	South Australia	.4
Germany	3.8	Cuba	.4
Spain	2.9	Italy	.3
Russia	1.5	Norway	.3
Algeria	1.2	Chosen	.2
India	1.0	Unfederated Malay States	.2
China	1.0	All others	.9
Chile	.9		
Czechoslovakia	.8	Total	100.0

[1] Mineral Resources of the United States, issued yearly, formerly by the United States Geological Survey but recently by the Bureau of Mines; The Mineral Industry, issued yearly by McGraw-Hill Book Company; *Engineering and Mining Journal;* Yearbooks of the American Bureau of Metal Statistics; Various other books and periodicals.

[2] The information available for 1926 is too incomplete for the making of a table of this sort.

In the production of iron ore the United States has been the outstanding nation for years (Figure 1).

Before the World War Germany ranked next to the United States, its production coming largely from the Lorraine field. By the terms of war settlement France obtained the Lorraine field, and, as a consequence, now ranks second in iron ore production while Germany's production is relatively small.

Great Britain normally ranks third in iron ore production, the low figure of 1926 being due to the British coal strike of that year which resulted in the temporary shutting down of most of the blast furnaces and steel mills.

No great changes in the sources of iron ore are likely in the near future aside from a return of Great Britain to third place.

COAL

Figures in *The Mineral Industry* for 1926 indicate the following sources of the world's coal in 1925[3]:

	Approximate per cent of total		*Approximate per cent of total*
United States	38.8	Australia	1.0
Germany[4]	20.0	Union of South Africa	.9
Great Britain	18.2	Canada	.9
France	3.5	Netherlands	.5
Czechoslovakia	2.2	Spain	.5
Japan	2.2	Hungary	.5
Poland	2.1	Jugoslavia	.3
Belgium	1.7	Austria	.2
British India	1.6	All others	2.3
China	1.5		
Russia	1.1	Total	100.0

In coal as in iron the United States is the leading producer and has been for many years (Figure 1).

Great Britain and Germany have alternated in second place. The low production of Great Britain in 1926 was due principally to the British coal strike of that year.

Aside from a return of Great Britain's production to normal no important changes in the sources of the world's coal seem imminent.

[3] The information available for 1926 is too incomplete for the making of a table of this sort.

[4] Figure given for Germany's production includes that of the Saar Basin.

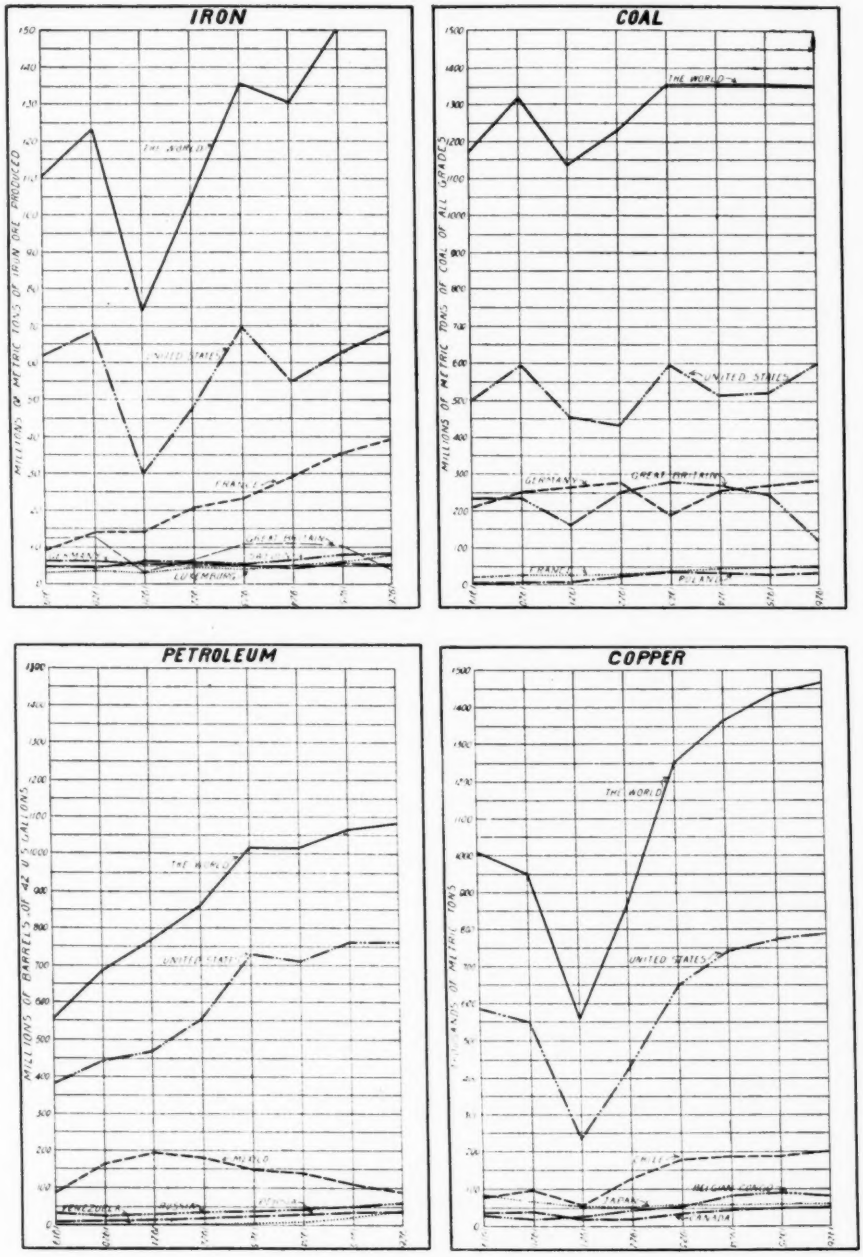

FIG. 1. Recent curves of the leading producers of iron, coal, petroleum, and copper

PETROLEUM

According to estimates in *The Mineral Industry* for 1926 the world's petroleum production for 1926 came from the following countries in the proportions indicated:

	Approximate per cent of total		*Approximate per cent of total*
United States	70.5	Argentina	.6
Mexico	8.2	Colombia	.6
Russia	5.7	Poland	.5
Venezuela	3.4	Trinidad	.5
Persia	3.2	British Borneo	.4
Rumania	2.1	Japan	.2
Dutch East Indies	2.0	Egypt	.1
Peru	1.0	Canada, Italy and all others	.3
India	.7		
		Total	100.0

The United States is the outstanding producer of petroleum, a position it has long occupied (Figure 1). This dominance is more marked in the case of petroleum than in that of any other mineral commodity of the group being discussed, the United States producing in 1926 nearly nine times as much petroleum as its nearest competitor.

Mexico's production has been declining for several years and recent petroleum laws in that country will probably make conditions worse.

Advance reports indicate that Venezuela will rank second to the United States in 1927 due to a marked increase in production during the last year.[5] Continued increase in the output of Venezuela and decrease in that of Mexico are to be expected.

COPPER

Estimates as given in *The Mineral Industry* for 1926 indicate the following sources of the world's copper for the year 1926[6]:

	Approximate per cent of total		*Approximate per cent of total*
United States	53.7	Canada	3.9
Chile	13.8	Spain and Portugal	3.9
Belgian Congo	5.4	Mexico	3.8
Japan	4.5	Peru	2.6

[5] Straus, Lester W., *Engineering and Mining Journal*, Vol. 125, p. 134, 1928.

[6] The figures given here as well as those used in the production curves for copper are smelter output figures. Since practically all copper ore is smelted in the country of origin these figures give a good comparison of the various countries as sources of copper ore.

Germany	1.5	Jugoslavia	.7
Africa (other than Belgian Congo)	1.2	Bolivia	.5
Norway	.9	Austria	.3
Russia	.8	Sweden	.1
Cuba	.8	Other countries	.9
Australasia	.7	Total	100.0

In copper, just as in iron ore, coal and petroleum, the United States is the leading producer. Chile and Belgian Congo, second and third in rank respectively, together produce only about one-third as much copper as the United States.

No important changes in the sources of the world's copper seem probable for some years to come.

Lead

The only world production figures available for lead show output by countries where smelted. Since the ore is not always smelted where it is mined it follows that such data do not present a true picture of the actual lead mined in a given country and hence of the importance of that country as a primary source of lead.

The leading mine producers of lead in 1926 seem to have ranked about as follows:

United States	Canada
Mexico	Germany and Upper Silesia
Australia	Burma
Spain	

The necessary figures are not available for arriving at the percentage of each. There are several minor producers not here listed.

It is not likely that there will be any important changes in the order of the various countries in the mine output of lead in the near future with the exception of a probable decline in Spain's production. The Spanish deposits are said to be about worked out.

Zinc

Available figures of the mine production of zinc from the various countries are far too incomplete to arrive at percentages of the world's total produced by the various countries for any recent year. These figures indicate, however, that the leading regions in the mine production of zinc in 1926 ranked about as follows:

United States	Italy
Poland	Canada
Australia	Germany
Mexico	North Africa (Algeria and Tunis)
Spain	

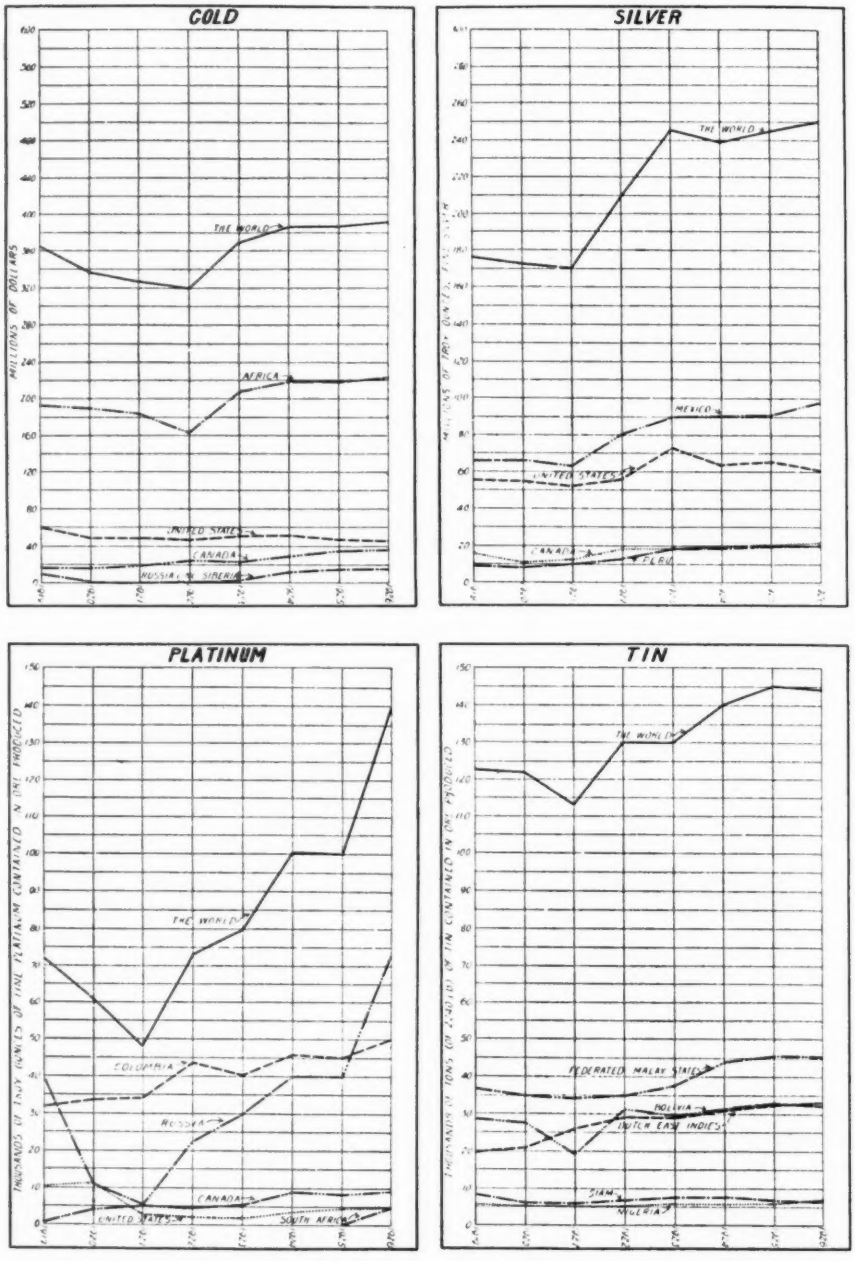

FIG. 2. Recent curves of the leading producers of gold, silver, platinum, and tin

Gold

Estimates as given in *The Mineral Industry* for 1926 indicate following sources of the world's gold for the year 1926:

	Approximate per cent of total		*Approximate per cent of total*
Transvaal	52.1	Rhodesia	3.1
United States (inc. Philippines)	12.0	South America	2.5
Canada	9.2	Japan and Chosen	2.2
Russia (inc. Siberia)	4.2	British India	2.0
Mexico	4.0	All others	5.4
Australia and New Zealand	3.3	Total	100.0

In the production of gold the Transvaal district of South Africa has for some years been in the lead with the United States second but far behind (Figure 2). The steady decrease in the output of the United States and the continued slight increase of Canada's output indicate the probability of Canada ranking next to the Transvaal before many years.

Silver

According to estimates in *The Mineral Industry* for 1926 and elsewhere the world's silver came, in 1926, from the following sources:

	Approximate per cent of total		*Approximate per cent of total*
Mexico	38.9	Japan and Chosen	2.4
United States (inc. Philippines)	24.6	British India (inc. Burma)	2.0
Canada	8.9	Germany	1.6
Peru	7.9	Spain	1.3
Australia and New Zealand	4.5	Central America	1.2
South America (outside of Peru)	4.0	East Indies, Dutch	1.0
		All others	1.7
		Total	100.0

In silver as in gold the United States ranks second with the same tendency of its production to decrease within recent years (Figure 2). It is interesting to note that North and South America together produced all but about 15 per cent of the world's total in 1926.

No important changes in silver production seem probable within the next few years.

Platinum

Very few countries produce important amounts of platinum. The estimated production for 1926 was as follows:

	Approximate per cent of total		*Approximate per cent of total*
Russia	51.6	South Africa	3.5
Colombia	34.8	United States	3.5
Canada	6.6		
		Total	100.0

For 1926 Russia led in the production of platinum but it is the first year since 1919 that Russia has produced more platinum than Colombia (Figure 2). The slump in Russian output for several years previous to 1926 was due to unsettled conditions in that country.

South Africa's appearance in the lists as an important platinum producing region is a recent event. It comes as a result of discoveries in 1924. These deposits are said to be unique in that they are the first ever worked for the primary recovery of platinum from an ore. In other deposits platinum has been obtained only by an alluvial operation or as a by-product in the working of some other metal. The production of South Africa for 1926 and for the first few months of 1927 was not as great as early reports suggested would be the case.

Russia will probably maintain its lead for some years, but not indefinitely. Before the War there were rumors that the Russian deposits would be worked out before many years. South Africa's production should continue to increase at least to the point of its ranking third in a few years.

TIN

According to the estimates in *The Mineral Industry* for 1926 the world's production for 1926 came from the following countries in the proportions indicated:

	Approximate per cent of total		*Approximate per cent of total*
Federated Malay States (British)	31.8	Unfederated Malay States	1.5
Dutch East Indies	22.8	Belgian Congo	1.2
Bolivia	22.2	India	.9
Nigeria	4.9	Union of South Africa	.8
Siam	4.8	Japan	.2
China	4.5	Portugal and Spain	.1
Australia	2.0	Other countries	.7
Great Britain	1.6	Total	100.0

The Federated Malay States, the Dutch East Indies and Bolivia are responsible for three-fourths of the world's tin produc-

tion. The Federated Malay States have led in production for a number of years but their lead has not been a very substantial one (Figure 2). The Dutch East Indies and Bolivia, each with a production over two-thirds as great as that of the Federated Malay States, have alternated in possession of second place for a number of years.

No great changes in the sources of tin are likely in the near future.

The Position of The United States

On the whole the United States occupies much the most favorable position as to mineral production among the nations. Of the commodities discussed it is first in the production of iron, coal, petroleum, copper, lead, and zinc, second in gold and silver, largely dependent upon other countries for platinum, and almost entirely dependent upon other countries for tin. Of those products in which the United States does not rank first gold comes principally from South Africa, silver from Mexico, platinum from Russia, and tin from the British Malay States.

USING INFORMAL TESTS IN GEOGRAPHY TO IMPROVE THE TEACHING-LEARNING PROCESS

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To construct an objective test that will serve as a scientific measuring device is not within the province of the ordinary classroom teacher. Yet she can devise simple informal tests to be scored objectively that will help to stimulate the teaching-learning process. There are several excellent sets of geography tests on the market but the tests that the teacher makes can be very carefully articulated with the work in the classroom. This close integration between measuring device and lesson taught is not always possible with purchased tests.

How shall these tests be constructed? First, let us consider a definite topic that is usually taught in fifth, sixth or seventh grade geography. These lesson plans on *Cotton* which follow are planned for four days' work. They do not indicate teaching methods, but simply subject matter to be covered. The informal

tests based on this material are given together at the end of the lessons.

LESSON I

I. Approach

Discuss the materials from which clothing is made. Which materials are used in making summer clothing? Why is cotton used more than silk?

II. Development (Outline of subject matter)

1. Leading countries for cotton production
2. Leading states in the United States
3. Natural requirements for cotton production
   a. Length of growing period
   b. Amount of precipitation
   c. Nature of soil
4. Influence of the above requirements on the distribution of cotton growing areas
5. Various kinds of cotton—where produced
   a. Sea island
   b. Egyptian
   c. Upland

III. Summary: Informal Test Number One

LESSON II

I. Review

Have the leading cotton producing areas of the world and the United States pointed out on the wall map. Consider the factors that prevent cotton from being raised farther north, west, or south in the United States.

II. Development (Outline of subject matter)

1. Preparation of soil and planting of seeds
2. The cotton plant—appearance, boll, seeds
3. The boll weevil—depredations, control
4. Preparation of raw cotton for market
5. Eli Whitney's contribution
6. Cotton concentration cities of the South—Galveston, Mobile, Charleston, New Orleans, Savannah

III. Summary: Informal Test Number Two

LESSON III

I. Review

Oral description of the cotton plant. Have names and locations of several cotton concentration cities of the South given.

II. Development (Outline of subject matter)

1. Cities of the United States to which raw cotton is shipped—Manchester, Pawtucket, New Bedford, Fall River, Providence
2. Foreign country which imports large amounts
   a. Reasons for England's importance in cotton weaving
   b. Advantages of the Lancashire district for weaving
   c. Relation between the cotton crop of southern United States and the prosperity of English mills

3. Cities in southern United States that weave cotton
   a. Why located near Fall Line
   b. Why only coarser fabrics are produced
4. Route of a cargo of cotton from New Orleans to Fall River
5. Route from New Orleans or Galveston to Manchester, England

III. Summary: Informal Test Number Three

LESSON IV

I. Review

Have these cities located orally, using the wall map: cotton concentration cities of southern United States; cotton manufacturing cities of New England; cotton manufacturing district of England.

II. Development (Outline of subject matter)

1. Other countries from which England imports raw cotton
2. Why it is possible to raise cotton in Egypt
3. Routes of a cargo of raw cotton from Egypt to England; from India to England
4. Markets for the finished product
5. By-products of the cotton plant

III. Summary: Informal Test Number Four

TESTING THE RESULTS

Informal Test Number One

1. Fill each blank with the correct word.

Much raw cotton is produced in a....., United States. Altho United States produces more than one b..... of the world's cotton, c..... in Africa and d..... in southern Asia also produce large amounts.

The growth of cotton is limited by certain conditions of temperature, precipitation, and soil. It requires e..... months of weather free from frost, from f..... to g..... inches of rainfall and h..... soil. If there is too much rain the plant produces a heavy growth of foliage and few cotton bolls.

2. At present, the cotton producing area of the United States is definitely limited by certain factors. Cotton cannot be raised farther west because there is .....; it cannot be raised farther north because there is .....; and it cannot be raised farther south because there is .....

Here are the items needed to complete this paragraph. Find the item that will correctly fill the first blank and write the letter of that item in the first blank. Do the same for the other blanks and items. You will have one item left over.

a. too much rainfall and cloudy weather
b. too dense a population
c. too little rainfall
d. too short a growing period

3. Answer in one word.

What must be practiced if cotton is to be raised in the arid regions of California, Arizona, and New Mexico?

Key for marking

1. a. southern
   b. half
   c. Egypt
   d. India
   e. seven
   f. thirty
   g. fifty
   h. limy
2. c; d; a
3. irrigation

Informal Test Number Two

1. Arrange these items in their correct order to show the steps in producing raw cotton.
   a. preparation of the soil
   b. baling
   c. picking the ripened bolls
   d. transporting it to a cotton concentration city
   e. planting the seeds
   f. chopping the young plants
   g. fighting the boll weevil
   h. ginning
2. Locate these cities by state.
   a. Galveston
   b. Mobile
   c. Charleston
   d. New Orleans
   e. Savannah

Key for marking

1. a; e; f; g; c; h; b; d
2. a. Texas
   b. Alabama
   c. South Carolina
   d. Louisiana
   e. Georgia

Informal Test Number Three

1. Select three cities that engage in cotton weaving on a very large scale: Boston, Fall River, Pawtucket, New Orleans, Manchester.
2. Copy the five best reasons that explain why New England weaves so much cotton goods.
   a. There are prevailing damp west winds in the cotton weaving area.
   b. The numerous lakes provide quantities of clear, pure water.
   c. Cotton cloth is the only article that New England can manufacture.
   d. Power to run the mills is easily obtained.
   e. There are excellent facilities for shipping the finished product.
   f. Great Britain provides a ready market for the cotton cloth woven in New England.
   g. Raw cotton is easily obtained.
   h. Agriculture is not profitable.
   i. They have many machines for weaving cotton cloth.
3. Copy the reason that best explains why Great Britain favored the South during the Civil War.
   a. Many of the Southerners were descended from Englishmen.
   b. The South supplied raw material for England's mills.
   c. The North never traded with England and the South did.

Key for marking

1. Fall River; Pawtucket; Manchester
2. a; b; d; e; g
3. b

Informal Test Number Four

1. Large quantities of raw cotton are shipped from Alexandria, Egypt, to Manchester, England. The ship passes over these bodies of water. Copy them, arranging them in their correct order.

   a. Strait of Gibraltar
   b. Manchester Ship Canal
   c. St. George's Channel
   d. Mersey River
   e. Mediterranean Sea
   f. Irish Sea
   g. Atlantic Ocean

2. Copy column **A** on your paper. After each item in column **A** write the item chosen from column **B** which belongs with it. There will be one item from column **B** left over.

A	B
1. Seven months of frost-free weather	a. is the region where the cotton weaving cities of the South are located.
2. New Orleans	b. is harmful to ripened bolls.
3. The Fall Line	c. is a city that imports raw cotton from India.
4. Sea-island cotton	d. connects the Mediterranean Sea and the Atlantic Ocean.
5. A delta	e. is cotton having long fibers.
6. Manchester, England	f. is required for growing cotton.
7. Florida Strait	g. connects the Gulf of Mexico and the Atlantic Ocean.
8. Strait of Babel Mandeb	h. removes seeds from the cotton fiber.
9. Heavy rainfall	i. is the sediment which a river deposits at its mouth.
10. Ginning	j. is a city shipping raw cotton.
	k. connects the Red Sea and the Gulf of Aden.

Key for marking

1. e; a; g; c; f; d; b

2.

1. f	3. a	5. i	7. g	9. b
2. j	4. e	6. c	8. k	10. h

These tests may be mimeographed or written on the board. The directions for test Number One are suited for mimeographed copies and must be modified slightly if the test is written on the board. The directions for the other tests are adapted for writing the tests on the blackboard and will require modification if mimeographed copies are used.

The tests are merely suggestive and the teacher may modify them or supplement them to suit the needs of her class. The tests can be marked by the children or by the teacher. The teacher should use the results of the tests as a guide for remedial work in the next lesson. Tests similar to these can be constructed by the teacher to check the work on any unit of subject matter in geography.

NATIONAL COUNCIL MEETING

December, 1928

The next annual meeting of the National Council of Geography Teachers will be held at Teachers College, New York City, December 26 and 27. The American Association for the Advancement of Science and the Association of American Geographers will hold their meetings in New York the same week. These three organizations will present a vast amount of material of vital interest to anyone interested in geography. New York is easy of access and offers many inducements to visitors from other sections of the country. This is an unusual year and you should make your plans now. Railroad rates of a fare and one-half on the usual Certificate plan will be available for the meeting.

Preliminary Program

Wednesday, December 26, 2:00-4:30 P.M.

1. Needed Studies in the Field of Educational Geography
   DEFOREST STULL, Teachers College, New York City
2. Subsidiary Objectives in Geography in Teacher Training Institutions
   ROBERT M. BROWN, Rhode Island College of Education, Providence, R.I.
3. The Preparation of Geography Teachers for the Elementary School.
   LOUIE G. RAMSDELL, State Normal School, Framingham, Mass.
4. Some Thoughts on Junior High School Geography
   FRANKLIN C. ROBERTS, Boston University, Boston, Mass.
5. Diagrams That Explain Themselves
   MARK JEFFERSON, Michigan State Normal College, Ypsilanti
6. Effective Classroom Demonstration of the Relationships between the Earth and Sun
   ISABELLE K. HART, State Normal School, Oswego, New York
7. Visual Aids in Geography Teaching
   WILLIAM M. GREGORY, Cleveland School of Education, Cleveland, Ohio

Wednesday, December 26, 8:00-10:00 P.M.

1. The Element of Adventure in Teaching and Learning Geography
   WILLIAM C. BAGLEY, Teachers College, New York City
2. Report of International Geographical Congress at London and Cambridge, England
   WALLACE W. ATWOOD, Clark University, Worcester, Massachusetts
3. The Scrambled Egg and the Social Sciences
   J. RUSSELL SMITH, Columbia University, New York City

Thursday, December 27, 9:00-12:00 A.M.

1. Presidential Address—Geography and World Citizenship
   LEONARD O. PACKARD, Teachers College of the City of Boston
2. Enriching the Geography Curriculum with Current Material
   JULIA M. SHIPMAN, University of Tennessee, Knoxville

3. Effective Teaching Thru the Use of Maps
   HARLEY P. MILSTEAD, State Normal School, Montclair, New Jersey
4. The Use of Maps
   J. PAUL GOODE, University of Chicago
5. Report of Committee on Junior and Senior High School Geography
   A. E. PARKINS, Chairman, George Peabody College for Teachers, Nashville, Tennessee
6. Report of Committee on Elementary School Geography
   ERNA GRASSMUCK, Chairman, State Teachers College, Indiana, Pennsylvania

Thursday, December 27, 2:00-4:00 P.M.

1. Problems Involved in Training Geography Teachers
   W. R. MCCONNELL, Miami University, Oxford, Ohio
2. The Place of Geography in Higher Education
   R. H. WHITBECK, University of Wisconsin, Madison
3. Geography in the Senior High School—"To Be or Not To Be"
   N. A. BENGTSON, University of Nebraska, Lincoln

Thursday, December 27, 6:00-9:00 P.M.

Annual Dinner
The Geography Curriculum of the Elementary School
FRANK M. MCMURRY, Teachers College, New York City
Discussion
Meeting of the Board of Directors and Executive Committee

Acknowledgment

Figure 1 in the article on "Manufacturing Industries," by R. H. Whitbeck, in the September *Journal* was used with permission of the American Book Company. The map appears in Mr. Whitbeck's "Industrial Geography." Thru an error proper credit was not given at the time of publication.

INTEREST-STIMULATING DEVICES

Riddles

Those who make up good riddles may put them on the board and in class we guess them—about two or three a day or more if given orally. These riddles are a few that were used in an original playlet for assembly.

1. The babe in the rushes—plus a form of the word "to be"—plus a bird's bill.
   Ans. Moz-am-bique
2. A girl's name—plus a form of the word "went"—plus a note in the scale.
   Ans. An-go-la
3. A great depth—plus a wrong—plus two vowels.
   Ans. Abys-sin-ia
4. What you want when something is good—plus an exclamation of surprise—plus the name of our college.
   Ans. Mor-o-cco (Coe)
5. A word for angry—plus "A"—plus what makes cars go—plus a vehicle.
   Ans. Mad-a-gas-car

M. MELVINA SVEC
Cedar Rapids, Iowa

Hidden American Cities

In each of the following sentences is the name of a large American city. The letters spelling the name are in their exact order. Underline the name of the city.

1. Those who have studied the life of Michael Angelo well know what an amazing genius he was.
2. The course of all rivers is toward the ocean.
3. In the spring, fields, hills, and streams invite us to get acquainted with the great outdoors.
4. Not royalty—but the common people deserve the credit of the world's progress.
5. When far from port, land, so long looked for, greeted their waiting eyes.
6. After his long absence, on his return he found all as he had left it.
7. I shall go on Monday to New Brunswick.
8. Mr. Smith is well read in general matters of current interest.
9. To become familiar with art for duty's sake is well, but for love's sake better.
10. Many people consider a den very necessary to the model home.

Have you Games or Other Devices?

It is probable that hundreds of teachers have worked out hundreds of geography games, puzzles, devices for use of pictures, maps, diagrams, lantern slides, etc., that would be of great assistance to others. Will you co-operate by writing out a clear description of one or a dozen that you have developed and send to the *Editor* of the *Journal?* Send us any teacher-aid and interest-stimulator that you have devised. SEND IT AT ONCE. Make your description as brief as is consistent with clearness. We will undertake to pass a large number of these devices on as an aid to others. Success depends upon your assistance.

GEOGRAPHICAL NOTES AND NEWS ITEMS

A chart, about 3′ by 2′, grafically depicting the nitrogen situation in the world, together with a 16 page report on "The Fundamentals of our Fertilizer Problem," has recently been issued by the Fuel-Power-Transportation Educational Foundation, 1014 Hartman Building, Columbus, Ohio. Teachers wishing copies may secure them free from this address.

According to this chart, in the United States 9 million tons of nitrogen are annually removed from the soil, and only about 5½ million tons are restored. More than half of this restoration is accomplished thru the use of manure and legumes, commercial fertilizers furnishing but a small fractional amount. Of these commercial fertilizers, 161,000 tons came from Chile, 150,000 from the distillation of coal and 13,000 are of atmospheric origin. The report estimates that if we burned by-product coke in our furnaces instead of soft coal and saved the nitrates from the coal used to produce the coke, we could not only eliminate unnecessary smoke muisance but produce annually 165,000 tons of nitrate. The latter figure is of added signficance when compared with the annual 40,000 tons production that Muscle Shoals was to furnish.

Daily bus service between Los Angeles and New York was inaugurated in September. The busses are routed over the Santa Fe Trail from Los Angeles to Denver; over the U. S. Highway from Denver to St. Louis; over the old National Trail from St. Louis to Pittsburgh; and over the Lincoln Highway from Pittsburgh to New York. Each seat has an overhead light for reading and may be used in a sitting or reclin-

ing position. The trip takes a little more than 5½ days. Stopover privileges are allowed.

This summer, for the first time, a train was routed over the new meter gauge track from Antofagasta, Chile, to La Paz. Formerly trains had to stop at the Bolivian-Chilean frontier to change both passengers and freight from the 2½ foot gauge of Chile to the meter gauge of Bolivia. More powerful engines will now attain so much more speed in climbing the Andes that at least 10 hours will be saved each trip. It is probable that the new route will not be in general use until next April. The international trains will carry a sleeper for Buenos Aires which will be detached from the main train at Uyuni, Bolivia. This sleeper will then continue to Tucuman, Argentina, where direct transfer must be made to a broad gauge train for Buenos Aires. By the new schedule passengers will no longer, as in the past, have to leave the train to spend the nights at mountain hotels.

To make students better acquainted with their country, the Swedish State Railways and the Swedish Tourist Association last summer placed special trains at the disposal of their students. The trains were routed thruout the entire length of the country. The cars were comfortably fitted so that they were the homes of the children while on the trip. The experiment was pronounced a great success and will probably be repeated next summer.

A weekly three day mail service has recently been established between Iquitos and Lima. Formerly this trip required 30 or more days. The mail now goes by airplane between Iquitos and San Ramon, Peru, a distance of about 600 miles. Automobiles then take it across the Andes for 60 miles to the railroad at Oroya which connects with Lima. Mail for the United States, Buenos Aires, and Montevideo is sent over the same route, the time of delivery being frequently done in half the former time when the mail was carried down the Amazon.

Another South America air service of considerable interest is a provisional fortnightly service between Colombia and Ecuador via Choco. Planes leave Barranquilla on Saturday morning, arriving at Buenaventura the same evening. After a night stop, the planes resume their flight to Guayaquil which is reached that afternoon.

GEOGRAPHICAL PUBLICATIONS

Thirty-one authors. *Problems of Polar Research,* IV. and 479 pp. with maps and illustrations. American Geographical Society, Special Publication No. 7. 1928.

Otto Nordenskjöld and Ludwig Mecking. *The Geography of the Polar Regions,* VI. and 359 pp., with maps and illustrations. American Geographical Society, Special Publication No. 8, 1928.

The Polar Regions hold the interest and imagination of every generation. Expedition after expedition, by ship, dogsledge, airplane, or dirigible, essays the exploration of these still relatively unknown areas of the earth's surface, and later startles the world with thrilling news of noble deeds and brilliant successes or tragic tales of

sordid suffering and dark failure; yet the great reading public, interested as it has always been, has little known where to seek trustworthy, authentic information regarding the geography of the polar regions.

Now he who runs may read, for the American Geographical Society, ever alert to serve where service is most needed in the field of geography, has published these two very concise but comprehensive volumes, written from different points of view, to supply the earlier lack: the latter to present clearly and fully all that is known at present; the former to present forcefully and suggestively the problems that still await solution. With a "Handbook of Polar Discoveries" by the veteran explorer General A. W. Greely to summarize the activities and achievements of all former polar exploration, "The Polar Regions" by Dr. R. N. Rudmose Brown to furnish a thoro general background of polar geography, and these two detailed, specialized books of the American Geographical Society in his library, or accessible to his hand for reference when required, any layman or student may so acquaint himself with all polar geography as to be adequately informed on almost every phase of the subject.

"Problems of Polar Research" is a series of papers by thirty-one specialists, nearly all of the thirty-one being the foremost men in their respective fields. Such illustrious names in Arctic research as Fridtjof Nansen, A. P. Coleman, Knud Rasmussen, Vilhjalmur Stefansson, Erick von Drygalski, Sir Douglas Mawson, R. N. Rudmose Brown, Richard E. Byrd, George H. Wilkins, and Robert A. Bartlett, not to mention the score of others who are only slightly less brilliant, constitute a galaxy of Arctic "stars" of the first magnitude and insure an authenticity and ripe judgment for the work rarely achieved. It is somewhat disappointing to miss a few names of unquestioned leadership in their fields, like M. L. Fernald, C. H. Ostenfeld, M. P. Porsild or Eric Hulten, in Arctic botany; Lauge Koch in geology; or William H. Hobbs in meteorology; but their absence can probably be accounted for by the inability of these men to contribute because of pressure of their active research work now in progress.

The future of polar exploration and research is chiefly concerned with detailed regional studies extended over a period of years to supply sufficient data for trustworthy generalizations, such, for instance, as have been carried on by the Danes in Greenland, with their Arctic Scientific Station as a base for the last twenty years, and even longer, and by Norway and Sweden on their northern frontiers. This kind of research may not be so spectacular and sensational as the "dashes" of the past century, but it is likely to yield more valuable and substantial results. The fields in which this research are necessary are clearly indicated in "Problems of Polar Research."

"The Geography of the Polar Regions" merits the highest praise. In the first ninety pages, in a preface, six chapters, and a conclusion and bibliography, Otto Nordenskjöld sets forth brilliantly a general characterization of polar nature—the climate, the ice, the causes of the ice age, soils and landforms, vegetation and animal life, and the delimitation of the polar regions and their natural provinces. In the rest of the volume, some 250 pages, Ludwig Mecking treats the Arctic and the Antarctic regionally and each region in detail, incorporating all the latest and most satisfactory achievements and knowledge. The work is exhaustively and excellently done.

The excellence and completeness, as well as the interest and research value, of these two volumes is unquestionably due to the able editing done by W. L. G. Joerg, who was entrusted with this responsibility. Thanks to his critical and thoroly scientific point of view in preparing these volumes for publication and Isaiah Bowman's vision

and energy in planning them and finding funds to finance them, we now have satisfactory and adequate source material for our studies of the polar regions.

W. ELMER EKBLAW

Clark University

Albert Perry Brigham. *The United States of America.* 308 Pages, 40 Maps. University of London Press. London, 1927.

Professor Brigham's latest book is an interpretation of the United States and its geography for use in the schools and universities of Great Britain, being based for the most part on a course of lectures given at the University of London in February, 1924. As the author states in his preface, the book is not a complete study of American geography, but rather a series of studies of "important phases of American geography." As might be expected from the author, the historical treatment permeates the entire book, giving it a certain strength and reality which is missing in purely non-historical treatments.

The range of subjects touched upon can best be presented by a review of the chapter headings. These are: The American Domain; Physiographic Provinces; Climate; The Distribution of Population; The Racial Composition; The Fruits of the Soil; Forests and National Parks; Underground Wealth; The Growth of Manufacture; Transportation; Commerce; Education; Traditions and Language; The Statehood Complex; and National Unity. There is an ample statistical appendix, and, following each chapter, a brief bibliography. The facts of distribution are ably treated with the aid of some forty maps. Some of the interpretations, however, may be open to doubt, especially those which lie by popular consent within the fields of economics, sociology, or politics. Professor Brigham fears the bad results of urban life, and is optimistic concerning the spread of manufacture to the smaller communities; his discussions are marked by a strong bias toward the stock and traditions of colonial America and especially New England—all of which involves him in some very moot questions, not amenable to any simple formula. One would do well to read Siegfried's "America Comes of Age" as an antidote. But these criticisms should not obscure the fact that otherwise his book must fill a very great need: a descriptive text covering the United States and its varied regional divisions with a strong historical interpretation, for use across the water.

PRESTON E. JAMES

University of Michigan

Branom, Mendel E. *A Teacher's Geography.* 252 pp. The Macmillan Company, New York. 1928.

The first thirty-nine pages of the book discuss in a general way such topics as professionalization of subject matter, the problem method, motivation of problems, objectives, etc. The remainder consists of outlines of topics and problems covering the various continents and countries of the earth.

Each region or area is treated under the same topical outline. First, under the heading, "Emphasis in Teaching," from two to four pages summarizes the leading facts with brief suggestions at the end as to what is to be stressed or emphasized. Then there follows for each region one or more topics or problems called "Integrating Centers." Each integrating center is organized under the following heads: (1) Introductory Exercises, (2) Discovery, (3) Problem, (4) Endeavor. The discussion of the topics outlined under "Introductory Exercises" are supposed to lead to a "Discovery"

which raises a "Problem" which the topics outlined under the heading "Endeavor" will explain or solve. Generally they tend to do this but not always because it is difficult to find integrating centers or problems for all regions which can be brought under such an outline. The problems are only outlined; the necessary information and facts must be sought elsewhere. Many such sources of information are suggested in the bibliography which accompanies nearly every region. These references are not graded but are very varied in kind, running from such children's literature as the Carpenter and Allen geographical readers to periodical literature and adult references. They are not graded into books for the children and books for the teacher. The book will be especially valuable to supervisors and well prepared teachers who know well the subject matter which is here treated in outline.

R D CALKINS

State Teachers College
Mt. Pleasant, Michigan

NEW BOOKS

D. H. Smith. **An Economic Geography of Europe.** 247 pp. Illustrated. Longmans, Green and Company, New York. 1925. $1.50.

An analysis of the industries and resources of each country taken as a whole, or divided into industrial units or natural regions.

J. Monroe Thorington. **The Glittering Mountains of Canada.** 310 pp. Illustrated. John W. Lea, 1520 North Robinson Street, Philadelphia. 1925.

A record of Exploration and Pioneer Ascents in the Canadian Rockies, 1914-1924.

William C. Redfield. **We and the World.** 194 pp. Illustrated. Silver, Burdett and Company, Newark, New Jersey. 1927. 84 cents.

By showing that our commodities in general use come from various environments, embracing the earth, the author of this supplementary reader aims to teach an appreciation of the interdependencies of peoples and the unity of the earth.

Charles Matheson. **North America.** 255 pp. Illustrated. Oxford University Press, American Branch, New York. 1927. $1.25.

Tho designed for the English School System, it should prove to be a valuable reference text for our elementary schools.

Walter Lefferts. **Our Neighbors in South America.** 306 pp. 112 illustrations. J. B. Lippincott Company, Philadelphia. 1927. $1.20.

A description of scenes and peoples visited by four young Americans while traveling along the coast and into the interior of South America.